AirCell Presentation to the Federal Communications Commission

A Case for Competitive Access and Broadband Applications within the Air-To-Ground Spectrum

October 13, 2004
FCC Docket 03-103

Overview of Presentation

- Core Elements of AirCell Plan
- Technical Capabilities and Parameters of AirCell Plan
- Satellite Services Not a True Competitive Alternative
- Airlines Need and Have Asked for Competition

Introduction

- **AirCell and Boeing have converged on a common approach for ATG broadband**
  - Responsive to airline desires for broadband and competition
  - Full broadband capability on flexible, shared basis
  - Protection for Airfone legacy service
  - Multiple invitations have been extended to Airfone

- **AirCell and Boeing agree that AirCell's Proposal promotes the NPRM's call for innovation, spectrum-efficiency and competition**

- **Proposal builds on prior AirCell innovation and success in FCC-supported spectrum re-use**
  - Opened critical safety and passenger sectors un-served by Airfone
  - Dramatically reduced equipment and service costs to General Aviation
  - ATG is natural home for AirCell customer migration to broadband

AirCell Proposal: Summary

- **Offers true BROADBAND competition**
  - Each system/operator is isolated from the others
    - **Broadband data rates reduced by less than 1% due to inter-system interference**
    - **Less than 1% probability for SINR degradation of 1dB+**
  - Each operator can offer the same broadband rate to the aircraft and seat as the “monopoly” / single operator case
  - Airlines and passengers benefit from ATG competition
- **“Off-the-shelf” technology used**
- **Full service all the way to the ground (deck-to-deck)**
- **Simple rules for spectrum sharing**

AirCell Spectrum Sharing Proposal

Cross-duplexing

- Provides isolation to have two operators overlapped in the ATG spectrum, each with full utility of a 3 MHz bandwidth

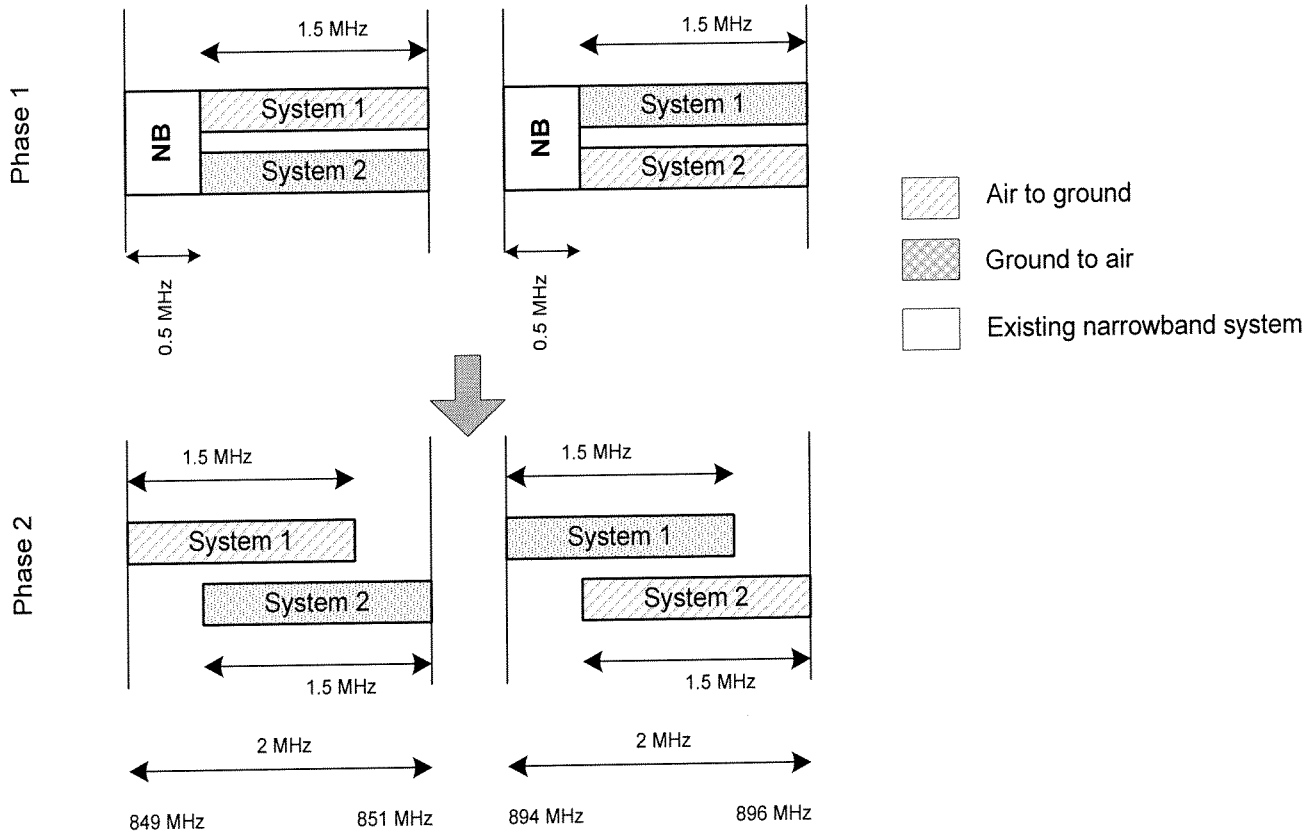
Cross-duplexing and Cross-polarization

- Provides isolation to extend from two operators to four operators
- Operators overlapped in the ATG spectrum, each with full utility of a 3 MHz bandwidth

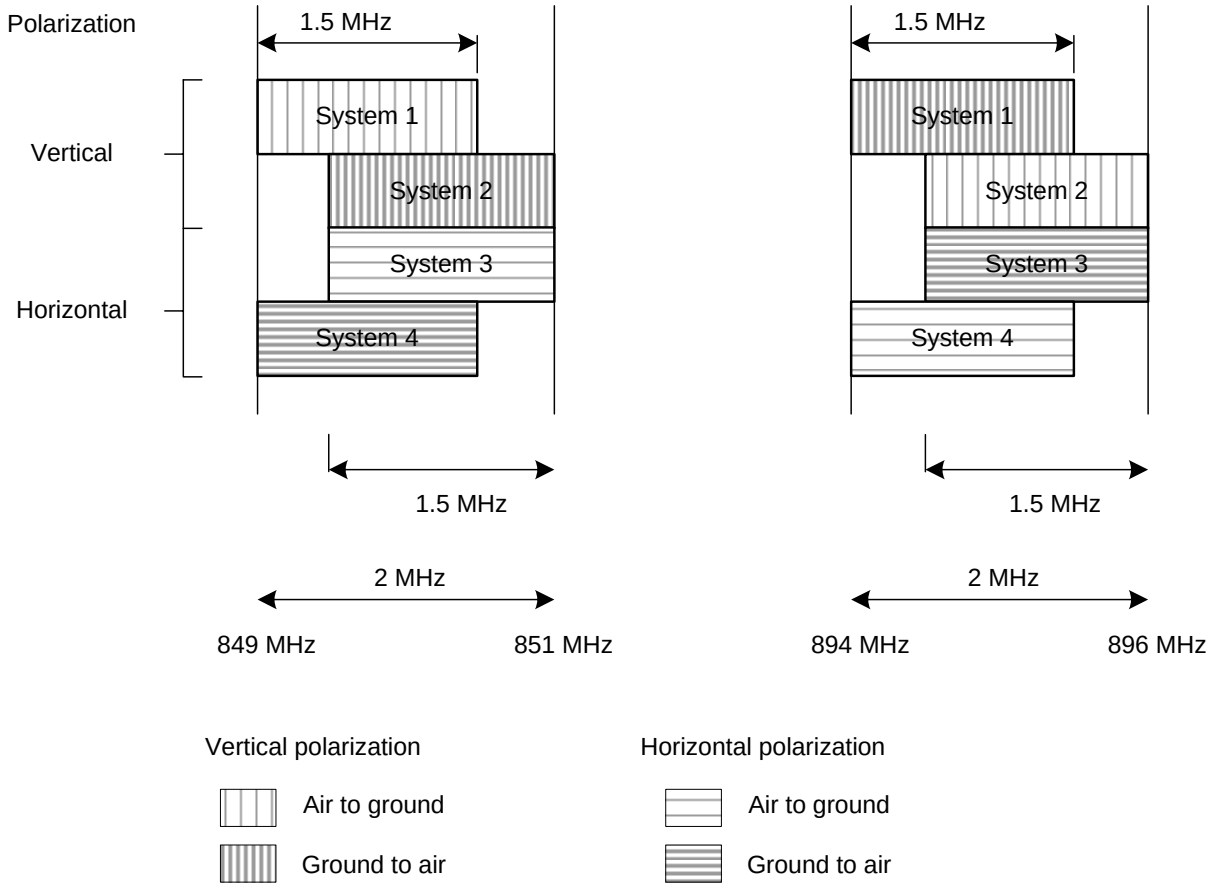
Accommodates incumbent network transition

- Full spectral overlap of broadband systems during transition time (3 MHz used for broadband and rest available for transition)
- Partial overlap of broadband systems after transition (using 4 MHz of ATG spectrum)

Two licensee proposal



Four licensee proposal



Spectrum Sharing Rules

- **Rules maintain inter-system isolation**
  - Also offer level playing field for all operators
  - Allow flexibility in network build-out, engineering and growth
- **Two types of rules**
  - Power/interference limits
  - Distance limits
- **Established FCC ground site and antenna notification requirements will facilitate coordination between broadband providers**
- **ATG band already allocated for a specific service**
  - Maximum flexibility is an appropriate goal to enable the largest number of potential uses – not applicable here

Spectrum Sharing Rules

Power limits

- "Primary Coverage Sites"
  - Maximum EIRP towards horizon of +53 dBm
  - Maximum antenna gain towards horizon of 13 dB
- "Capacity Sites"
  - Maximum EIRP towards horizon of +16 dBm
  - Maximum antenna gain towards horizon of -11 dB (>11dB loss)

- For both types of sites, interference limits are:
  - Power level in 1.5 MHz bandwidth 45 miles away shall be less than –98 dBm (referenced to isotropic Rx antenna 100 ft AGL)
  - Power level in 1.5 MHz bandwidth 65 miles away shall be less than –122 dBm (referenced to isotropic Rx antenna 100 ft AGL)

Spectrum Sharing Rules

✈ Distance limits

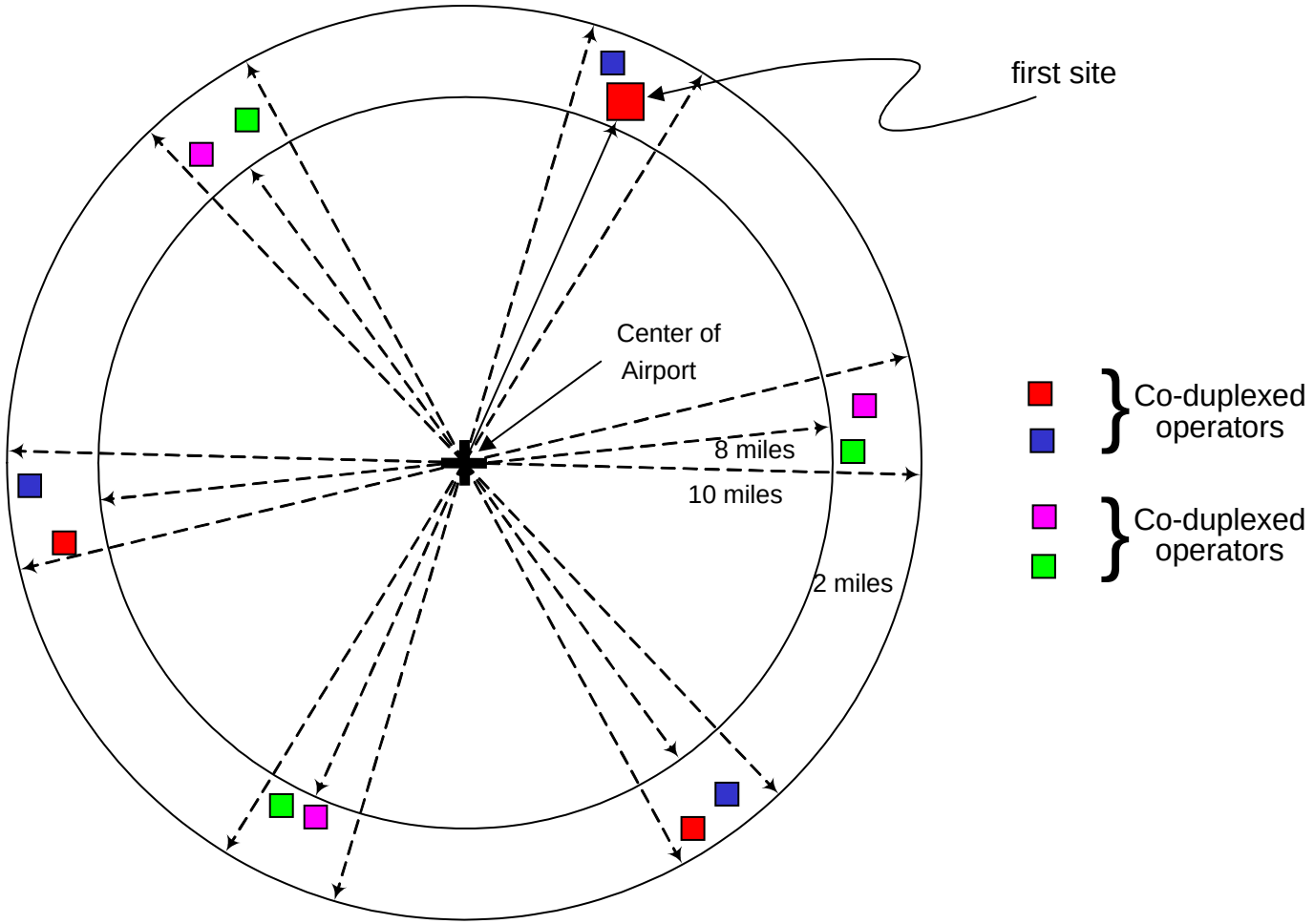
- Airport Scenario
  - 8-mile ring around airports
  - Up to 3 sites per operator (“Capacity Sites”)
  - On 3 alternate corners of the hexagon bounded by 8-mile ring (120° apart from center)

- Outside Airport Ring

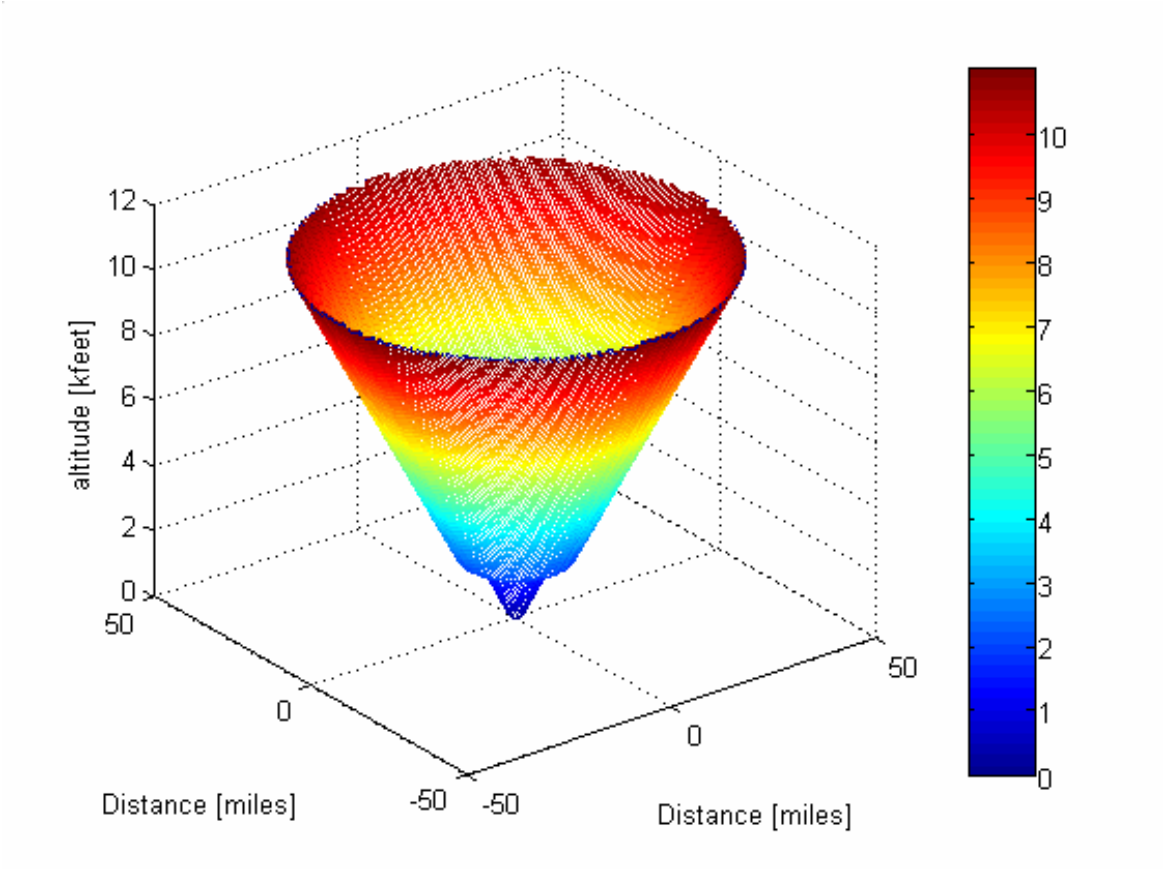
Minimum separation distances (miles)	Primary Coverage Site	Capacity Site
Primary Coverage Site	65	45
Capacity Site	45	10

  - No distance limitation for co-duplexed sites

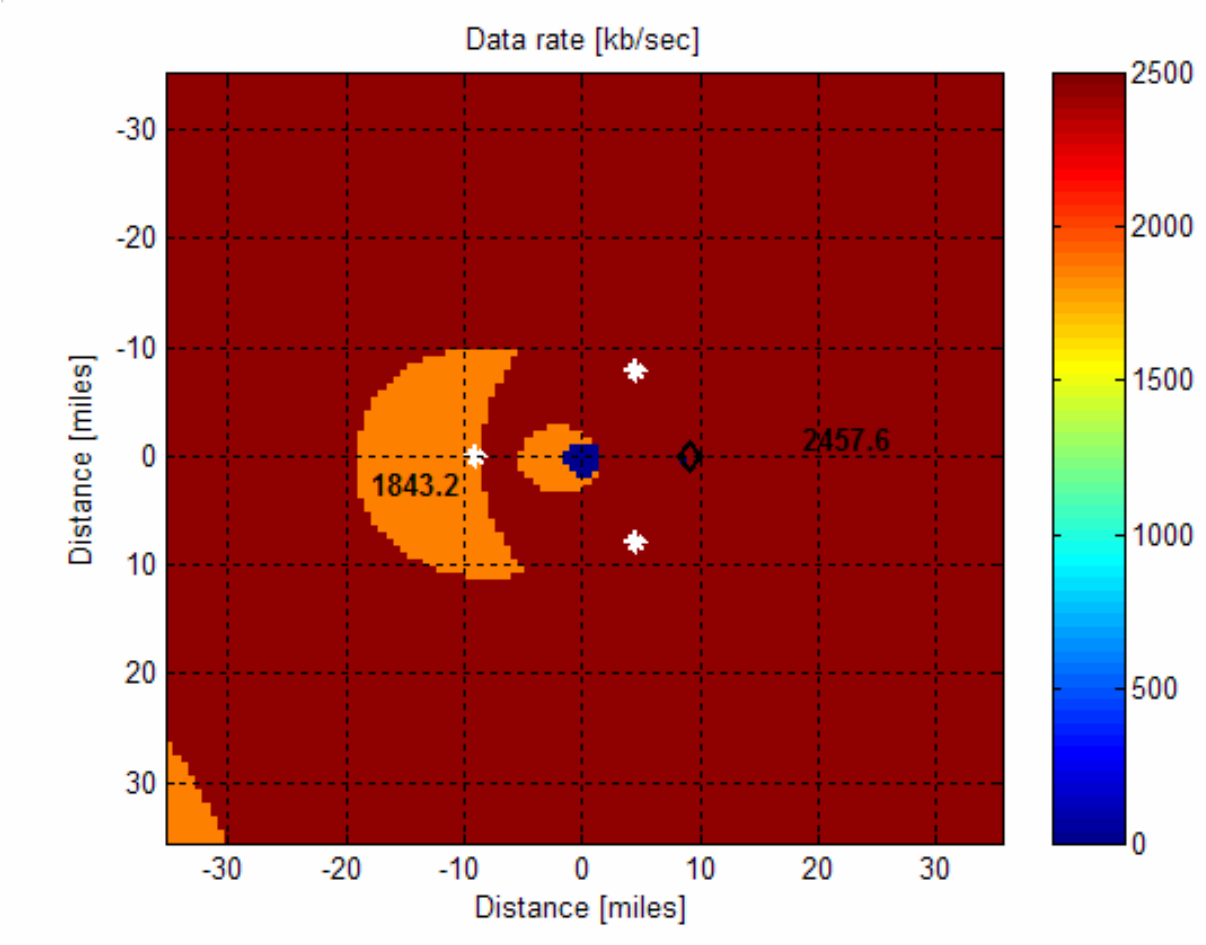
Airport Rules - Illustration



Arrival airspace “bowl”

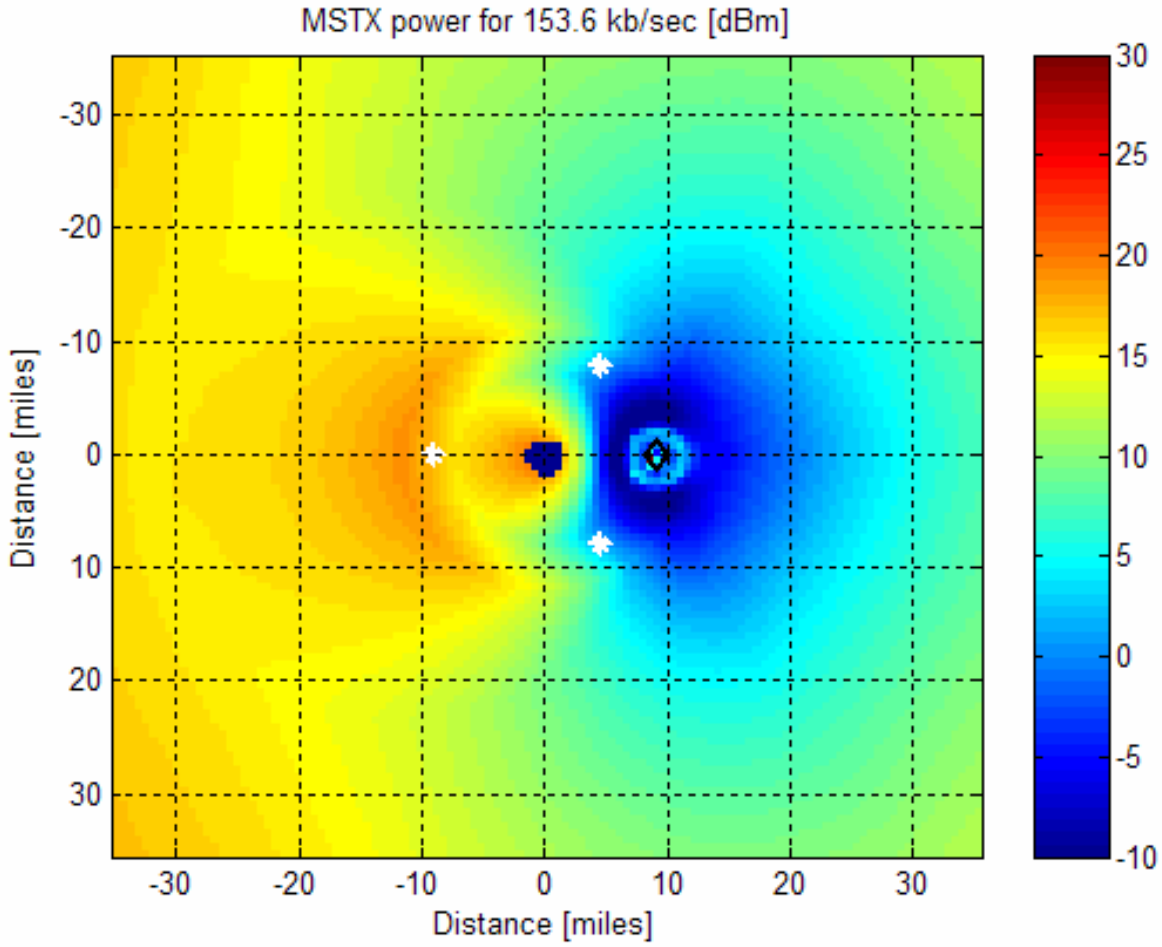


Airport – Forward link rate on bowl



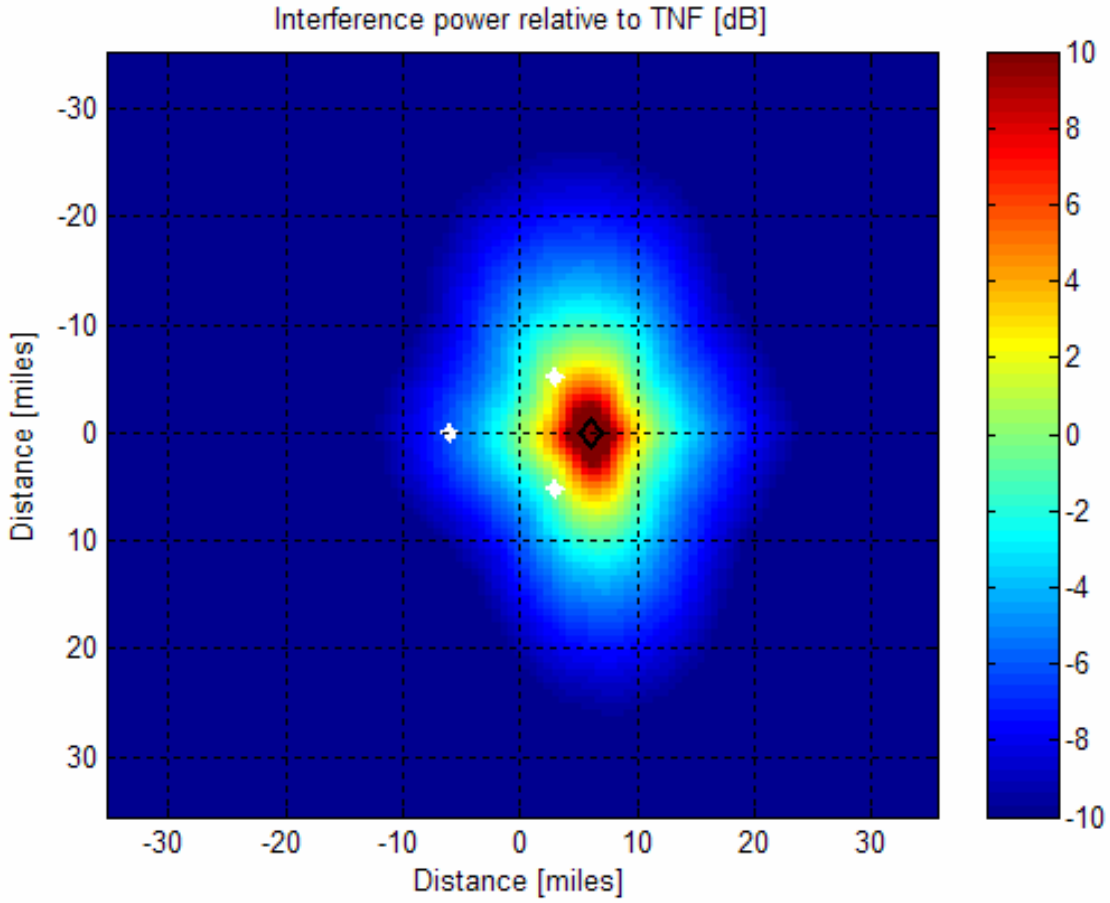
1 omni site on
9 mile ring

Airport – Mobile/aircraft transmit power



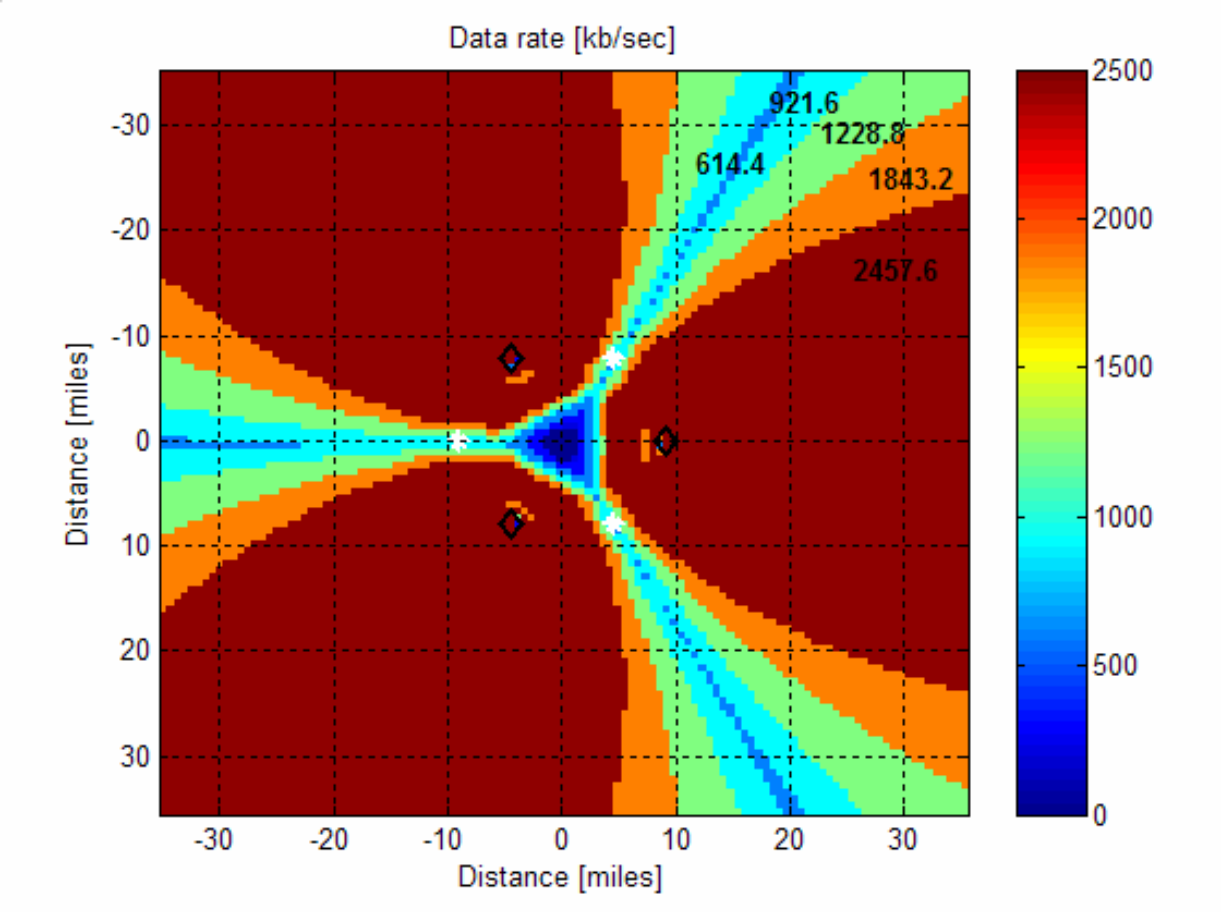
1 omni site on
9 mile ring
(50% loading)

Airport – Base to base interference



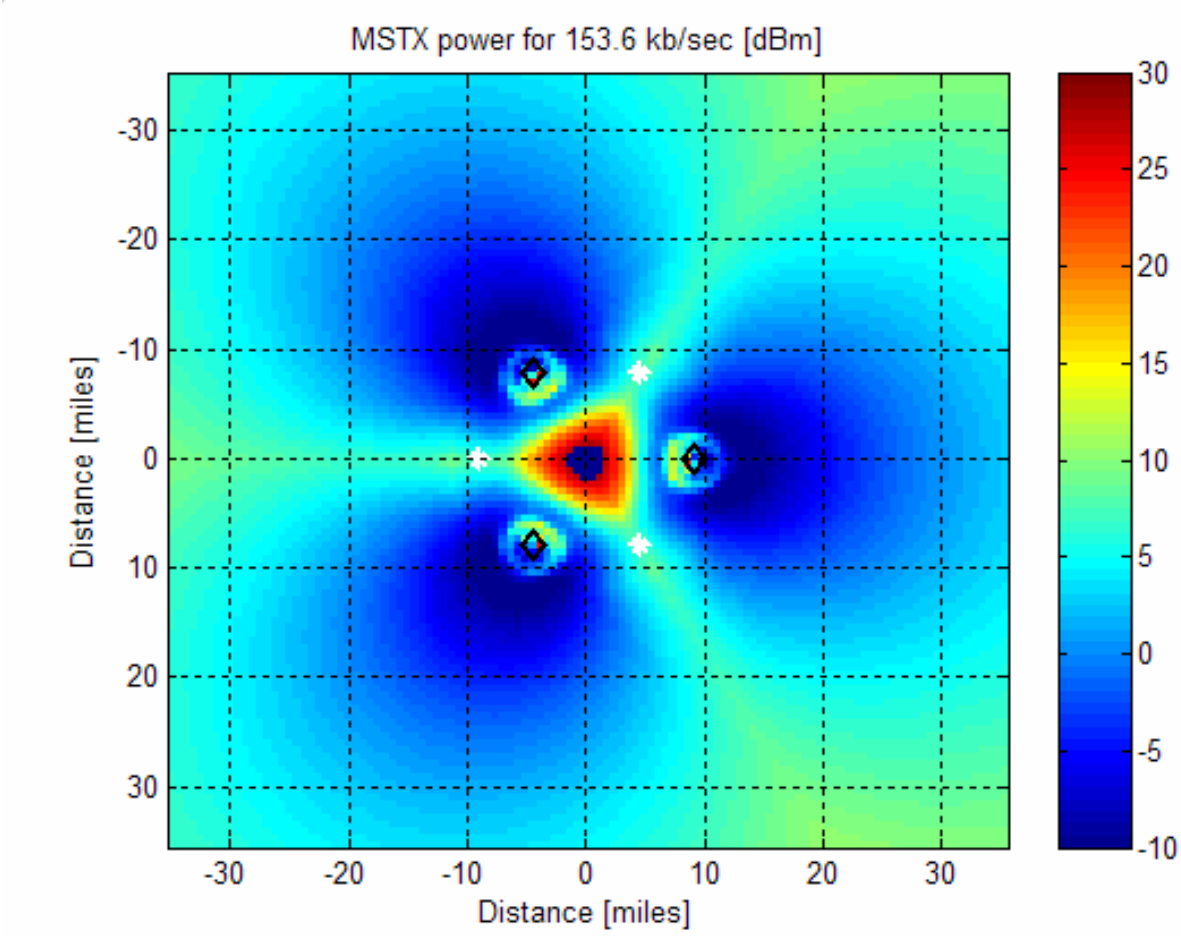
1 omni site on
6 mile ring

Airport – Forward link rate on bowl



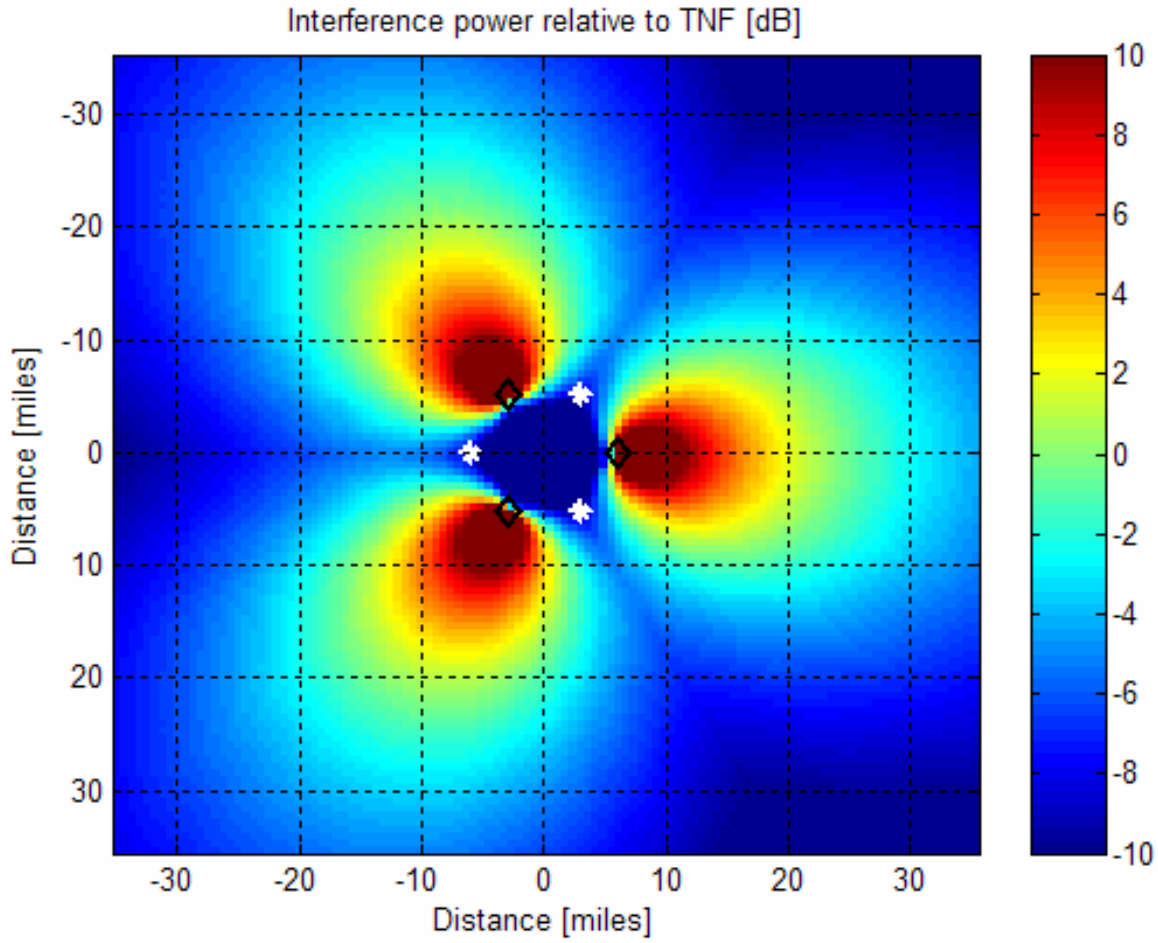
3 sectored sites on 9 mile ring

Airport – Mobile/aircraft transmit power



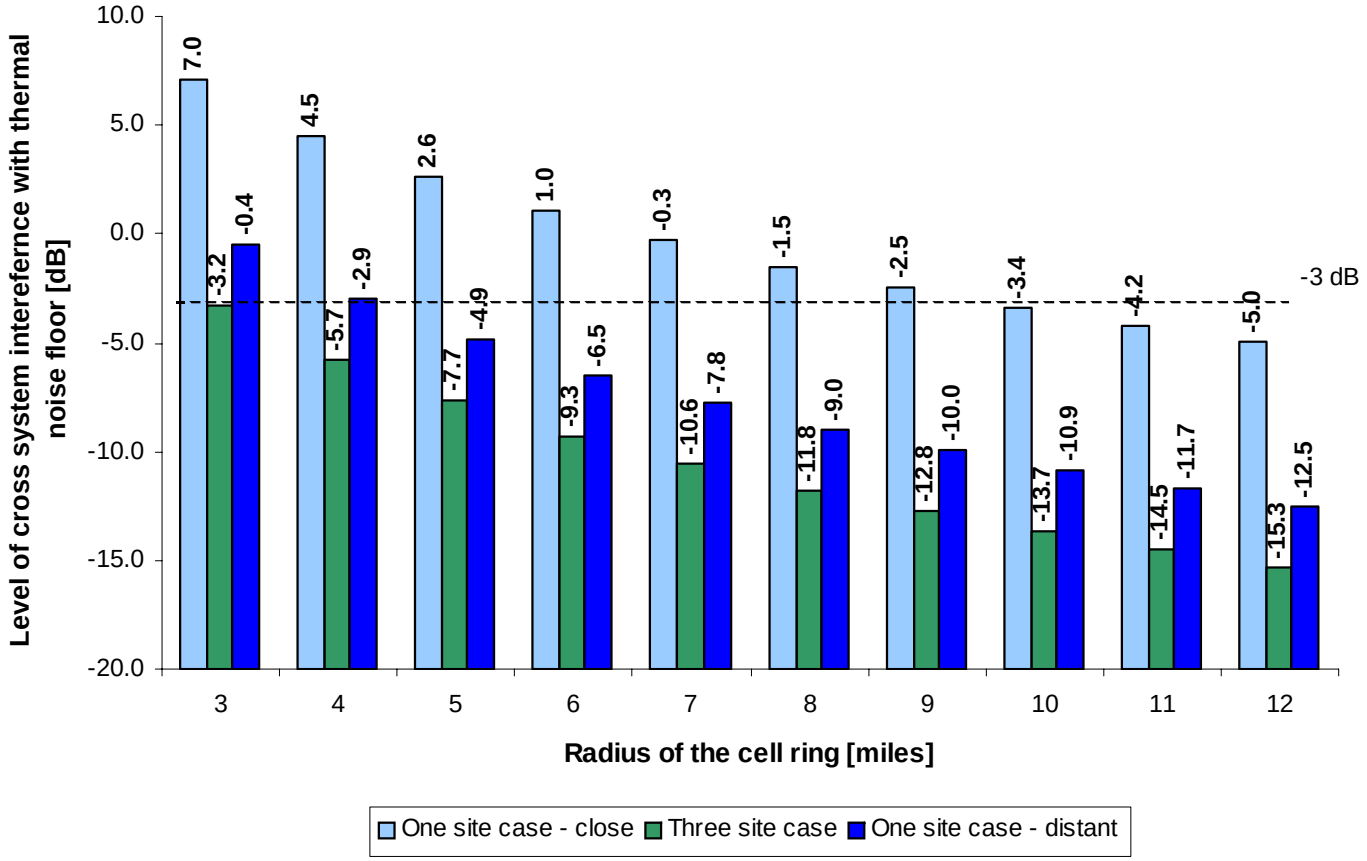
3 sectored sites on 9 mile ring (50% loading)

Airport – Base to base interference



3 sectored sites on 6 mile ring

Airport – Base to base interference



Deck-to-Deck Coverage

- **Full deck-to-deck coverage offered**
  - Broadband data rates offered
  - “Off-the-shelf” antennas used
  - Real world airport traffic patterns modeled
  - ATG network used above 200-300’ altitude
  - Hand-off to higher capacity terrestrial networks (with more spectrum) on ground and up to 200-300’ on approach/departure
- **Simple site coordination mechanism around airports**
  - Up to 3 sites per operator (on 8-mile ring)
  - Up to 4 operators can be accommodated
- **Multiple service providers (broadband systems) ease capacity problem around airports**

Interference Impact

Aircraft to aircraft interference is a non-issue

- FAA min. aircraft separation of 5 miles horizontal, 1000 ft vertical
- Exception: final approach at airports on parallel runways. Aircraft are then close to base stations, transmitting lower power (interference), receiving higher fwd power (C/I still supports broadband rates)

Base station-base station interference is a non-issue

- Airport solution demonstrated and rules developed
- Outside airport area, base stations are separated by 65+ miles
  - Base stations are beyond each other's radio horizon

Naval Radar interference claims are misleading

- Claim would indicate that radar spectral emission referred to by Telcordia would be causing interference today at 850 and 895 MHz
- To date no specific real-world data (amplitude, duration, location) has been provided to make this case

Airfone/Telcordia objections and analysis

- **Unrealistic assumptions used to support misleading statements and analysis**
  - 200 mile radius cell sites
    - Beyond radio horizon of aircraft flying below 15K feet
  - 20 Watt mobiles/aircraft
    - Not used in any broadband system in the world. Proper network engineering (cell size, antenna, data rates) eliminates the need for this
  - 10 dB additional path loss used in every ATG line-of-sight link
    - No original data provided to support this claim; AirCell's flight test results, which are quoted, include antenna pattern and obstruction loss effects
  - Analysis done by Telcordia/Airfone assuming ALL of the above
    - Improbable/impossible in engineered network

Airfone / Telcordia Misstatements

- **Airfone and Telcordia presentations misstate the facts about AirCell's proposals. The truth is:**
  - No performance penalty for multiple systems
  - AirCell is proposing CDMA, which will provide true broadband service
  - AirCell proposal will provide continuous full broadband coverage to the ground
  - Ample flexibility to innovate and evolve in the future with minor coordination requirements
  - Telcordia concerns are not based on realistic assumptions.

Broadband Network Costs & Transition Plan

- **AirCell, Boeing and Airfone propose the same technology – CDMA**
  - Equipment costs are the same whether there are 1, 2, or 4 operators
  - No special base station or aircraft antenna required

- **Incumbent network transition**
  - Airfone can keep all of its current sites for legacy system operation
  - Airfone to locate new airport sites for broadband services to comply with the proposed rules (level playing field)
  - Transition bandwidth for incumbent under the AirCell proposal is same as in the “broadband monopoly” scenario
  - Airfone needs only a fraction of 4 MHz for transition (1700 out of 8100 US aircraft fleet equipped with Airfone; low call/traffic volume)

Consequences of Airfone Proposal

- Exclusive access and pricing for Verizon Wireless customers
- No ATG partnership opportunity for other wireless carriers
- Incentive for larger airlines to collude with Airfone to limit service to smaller competing airlines
- Limits airline ability to negotiate best economic deal for itself and its passengers
- Higher consumer prices
- Only competition drives innovation and brings new services to the consumer
- Inefficient use of the only spectrum available for ATG

Space Data Shortcomings

- Cell phones and WiFi devices do not operate in the ATG spectrum
- If such could be made available, cell phones and WiFi devices do not put out sufficient power through the fuselage to reach balloons that can be 12-20 miles in altitude but 100+ miles away from the aircraft
- High power levels from user devices will be virtually impossible to certify with the FAA due to interference with avionics
- With frequency re-use needed, 1 MHz insufficient to meet ATG market demands
- Maintaining an ever-present fleet of balloons properly spaced across the nation is at best costly and at worst impossible

Even considering next generation solutions ...

- Using an ATG CDMA broadband terrestrial link a passenger will pay less than $0.50/minute for a voice call and the aircraft system will cost less than $100K installed.

Whereas ...

- The newest satellite offerings* will charge $2-7/min**, with equipment costs ranging from $500K to well over $1 million**

*Inmarsat IV, Connexion by Boeing, Rockwell-Collins eXchange, ARINC/Telenor, ARINC SkyLink
**Sources (4,5,6)

Majority of U.S. carriers have elected to not provide Airfone or satellite passenger telecom services

Alaska Airlines
American Airlines
America West
ATA
AirTran
Frontier Airlines
Independence Air
JetBlue Airways
Northwest Airlines
Southwest Airlines

Plus all Regional Airlines with the exception of United Express and Midwest Express

- **More than 6,400 aircraft are un-served (~79% of the U.S. fleet)[7]**
- **Airlines need competitive offerings and have made that request known to the FCC**

Conclusions ...

- AirCell and Boeing have converged on a common approach for broadband ATG
- Proposal supports competition criteria and NPRM requirements
- Offers ease of transition from legacy services to broadband
- Meets customer and market demands for low cost broadband services

Sources:

(1) ***Almost here: Cell phones at 37,000 feet*, Joe Sharkey, The New York Times, October 10, 2004**

"William E. Pallone, the president of Verizon Airfone Inc., concedes that those seat-back Airfones are falling out of favor quickly as travelers become more accustomed to fancy technology on the ground. 'At one time, at prices comparable to where we are today, we had as many as 15 users per aircraft, six or seven times as much usage as we have today,' he said, suggesting that seat-back phones have become like airport pay phones: useful when you really need them."

(2) ***Broad Verizon*, Inflight Magazine, Autumn 2004**

"Airfone points out that most US air travel is domestic and regional and says it would be more economically served by a terrestrial infrastructure." Quoting Airfone's President ... "Pallone says that acquisition, installation and support costs will be significantly less than those of satellite systems."

(3) **United Airlines magazine**

(4) ***Satcom Shakeout,* Fred George, as published in Business & Commercial Aviation, September 2004**

(5) ***The Activist Passenger*, Michael Mecham, Aviation Week & Space Technology, September 27, 2004**

(6) ***Taking the Connexion*, Inflight Magazine, Autumn 2004**

(7) **FAA data indicates 8,118 total U.S. commercial aircraft. Calculating 1,700 as Airfone-equipped results in 6,418 or 79% un-served.**